

Form PTO 1449 Rev. 7-80	U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	Atty. Docket No. CH8498US	Serial No. To Be Assigned
		Applicant Jagdish Narayan et al	
		Filing Date Herewith	Group No.

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	3,808,109	04/30/74	Schauer	204	38 A	
	AB	3,878,079	04/15/75	Schauer	204	192	
	AC	4,036,708	07/19/77	Feit et al	204	38	
	AD	5,281,485	01/25/94	Colgan et al	428	457	
	AE	5,406,123	04/11/95	Narayan	257	767	
	AF	5,882,399	03/16/99	Ngan et al	117	89	
	AG	6,110,598	08/29/00	Maeda et al	428	457	
	AH	6,291,885 B1	09/18/01	Cabral, Jr. et al	257	751	
	AI	6,395,148 B1	05/28/02	Whitman	204	192.15	
	AJ	6,441,492 B1	08/27/02	Cunningham	257	762	
	AK	6,458,255 B2	10/01/02	Chiang et al	204	192.5	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL	*98/54377	12/03/98	World				
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR	J. Appl. Physics 68(12), (month unavailable) 1990, pages 6207-6212, J.O. Olowolafe et al, "Interactions of Cu with CoSi ₂ , CrSi ₂ and TiSi ₂ with and without Tin _x barrier layers"
	AS	Materials Science and Engineering, R19 (month unavailable) 1997, pages 87-151, Shyam P. Murarka "Multilevel interconnections for ULSI and GSI era"
	AT	Annu. Rev. Mater. Sci., (month unavailable) 2000, pages 363-385, A.E. Kaloyeros et al, "Ultrathin Diffusion Barriers/Liners for Gigascale Copper Metallization"

EXAMINER	DATE CONSIDERED
EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Copies of documents previously submitted by WIPO.

Form PTO 1449 Rev. 7-80 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	Atty. Docket No. CH8498US	Serial No. To Be Assigned
Applicant Jagdish Narayan et al		
Filing Date Herewith		Group No.

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	6,746,940 B2	06/08/04	Queirolo et al	438	486	
	AB	6,770,977 B2	08/03/04	Kishida et al	257	761	
	AC	6,780,706 B2	08/24/04	Agarwal	438	240	
	AD	6,794,338 B2	09/21/04	Storer et al	505	237	
	AE	6,828,189 B2	12/07/04	Igarashi	438	239	
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR	Thin Solid Films 140 (month unavailable) 1986, pages 3-21, G. Ottaviani, "Metallurgical Aspects of the Formation of Silicides"
	AS	Jpn. J. Appl. Phys., Vol 35, Part 1, March 1996, pages 1844-1845, "Oxidation Behavior of Ta Thin Films as a Passivation Layer Deposited on Cu"
	AT	J. Vac. Sci. Technol. B 17(1), Jan/Feb 1999, pages 174-181, Dong-Soo Yoon et al, "Role of cerium dioxide in a tantalum diffusion barrier film for a Cu/Ta+CeO ₂ /Si structure"
EXAMINER		DATE CONSIDERED
EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.		

Copies of documents previously submitted by WIPO.

U.S. PATENT DOCUMENTS

FOREIGN PATENT DOCUMENTS

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)									
--	--	--	--	--	--	--	--	--	--

EXAMINER

DATE CONSIDERED _____

Copies of documents previously submitted by WIPO.

10/593809
IAP9/Rec'd PCT/PTO 20 SEP 2006

Sheet 4 of 11

Form PTO 1449 Rev. 7-80 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	Atty. Docket No. CH8498US	Serial No. To Be Assigned
Applicant Jagdish Narayan et al		
Filing Date Herewith		Group No.

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR		Superficies y Vacio 9, December 1999, pages 206-209, J.M.T. Molarius et al, "R.F.-Sputtered Tantalum-based diffusion barriers between copper and silicon"
	AS		Proceedings of the IEEE International Interconnect Technology Conference, 5 th , June 3-5, 2002, pages 179-181, Hilke Donohue et al, "Low-resistivity PVD α - tantalum: Phase formation and integration in ultra-low k dielectric/ copper damascene structures"
	AT		J. Vac. Sci. Technol. B 20(4), Jul/Aug 2002, pages 1321-1326, H. Kim et al, "Diffusion barrier properties of transition metal thin films grown by plasma-enhanced atomic-layer deposition"

EXAMINER	DATE CONSIDERED
EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Copies of documents previously submitted by WIPO.

Form PTO 1449 Rev. 7-80 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"> Atty. Docket No. CH8498US </td> <td style="width: 50%;"> Serial No. To Be Assigned </td> </tr> <tr> <td colspan="2"> Applicant Jagdish Narayan et al </td> </tr> <tr> <td> Filing Date Herewith </td> <td> Group No. </td> </tr> </table>	Atty. Docket No. CH8498US	Serial No. To Be Assigned	Applicant Jagdish Narayan et al		Filing Date Herewith	Group No.
Atty. Docket No. CH8498US	Serial No. To Be Assigned						
Applicant Jagdish Narayan et al							
Filing Date Herewith	Group No.						

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR	Journal of Applied Physics, Vol 90, No. 10, November 15, 2001, pages 5126-5134, J. Langer et al, "Microstructure and magnetic properties of sputtered spin valve systems"
	AS	Acta Metallurgica, Vol 25, (month unavailable) 1977, pages 1485-1490, S. Takeuchi et al, "Slip in High Purity Tantalum Between 0.7 and 40 K"
	AT	Surface Science 1 (month unavailable) 1964, pages 399-406, J.E. Boggio et al, "Low-Energy Electron Diffraction and Photoelectric Study of (110) Tantalum as a Function of Ion Bombardment and Heat Treatment"

EXAMINER	DATE CONSIDERED
----------	-----------------

EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.

* Copies of documents previously submitted by WIPO.

Form PTO 1449 Rev. 7-80 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"> Atty. Docket No. CH8498US </td> <td style="width: 50%;"> Serial No. To Be Assigned </td> </tr> <tr> <td colspan="2"> Applicant Jagdish Narayan et al </td> </tr> <tr> <td> Filing Date Herewith </td> <td> Group No. </td> </tr> </table>	Atty. Docket No. CH8498US	Serial No. To Be Assigned	Applicant Jagdish Narayan et al		Filing Date Herewith	Group No.
Atty. Docket No. CH8498US	Serial No. To Be Assigned						
Applicant Jagdish Narayan et al							
Filing Date Herewith	Group No.						

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR		Appl. Phys Lett., Vol. 61, No. 11, September 14, 1992, pages 1290-1292, J. Narayan et al, "Epitaxial growth of TiN films on (100) silicon substrates by laser physical vapor deposition"
	AS		Materials Science and Engineering, R29 (month unavailable) 2000, pages 115-152, L.J. Chen, "Solid state amorphization in metal/Si systems"
	AT		Journal of Applied Physics, Vol. 93, No. 1, January 1, 2003, pages 278-285 J. Narayan et al, "Domain epitaxy: A unified paradigm for thin film growth"

EXAMINER	DATE CONSIDERED
EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.	

* Copies of documents previously submitted by WIPO.

Form PTO 1449 Rev. 7-80 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	Atty. Docket No. CH8498US	Serial No. To Be Assigned
Applicant Jagdish Narayan et al		
Filing Date Herewith		Group No.

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR	Appl. Phys. Lett. 71(21), November 1997, pages 3069-3071, Kee-Won Kwon et al, "Evidence of heteroepitaxial growth of copper on beta-tantalum"
	AS	Appl. Phys. Lett. Vol. 81, No. 15, October 7, 2002, pages 2728-2730, S. Lopatin et al, "Z-contrast imaging of dislocation cores at the GaAs/Si interface"
	AT	Appl. Phys. Lett. Vol. 81, No. 8, August 19, 2002, pages 1453-1455, H. Wang et al, "Copper diffusion characteristics in single-crystal and polycrystalline TaN"
EXAMINER		DATE CONSIDERED
EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.		

Copies of documents previously submitted by WIPO.

10/593809

1AP9/Rec'd PCT/PTO 20 SEP 2006

Sheet 8 of 11

Form PTO 1449 Rev. 7-80 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	Atty. Docket No. CH8498US	Serial No. To Be Assigned
	Applicant Jagdish Narayan et al	
	Filing Date Herewith	Group No.

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR	Journal of Applied Physics, Vol. 92, No. 12, December 15, 2002, pages 7080-7085, H. Kim et al, "Growth of cubic-TaN thin films by plasma-enhanced atomic layer deposition"
	AS	J. Appl. Phys. 74(2), July 15, 1993, pages 1008-1014, Philippe Catania et al, "Phase formation and microstructure changes in tantalum thin films induced by bias sputtering"
	AT	Physical Review B, Vol. 30, No. 8, October 15, 1984, pages 4805-4806, M.A. Howson et al, "Temperature dependence of conductivity arising from electron-electron interaction effects in amorphous metals"

EXAMINER	DATE CONSIDERED
EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Copies of documents previously submitted by WIPO.

Form PTO 1449 Rev. 7-80 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	Atty. Docket No. CH8498US	Serial No. To Be Assigned
Applicant Jagdish Narayan et al		
Filing Date Herewith		Group No.

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR		Helsinki University of Technology, Department of Electrical and Communications Engineering Laboratory of Electronics Production Technology, December 14, 2001, pages 1-58, Tomi Laurila, "Tantalum-Based Diffusion Barriers for Copper Matalization"
	AS		*Ge S H et al: "Structures and magnetic properties of Co/Ta multilayered thin films" Physica Status Solidi a Germany, vol. 132, no. 2, 16 August 1992 (1992-08-16), pages 487-493, XP009052667
	AT		*Parfitt L J et al: "Origins of Residual Stress in Mo and TA Film: The Role of Impurities, Microstructural Evolution and Phase Transformations" Materials Research Society Symposium Proceedings, Materials Research Society, Pittsburg, PA, US, vol. 436, 8 April 1996 (1996-04-08), pages 505-510, XP002074085

EXAMINER	DATE CONSIDERED
EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Copies of documents previously submitted by WIPO.

Form PTO 1449 Rev. 7-80 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	Atty. Docket No. CH8498US	Serial No. To Be Assigned
Applicant Jagdish Narayan et al		
Filing Date Herewith		Group No.

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR		*French B. L et al: "Correlation of stress and phase evolution in thin Ta films and Si (100) during thermal testing" Surface Engineering 2002 – Synthesis, Characterization and Applications. Symposium (Mater. Res. Soc. Symposium Proceedings Vol. 750) Mater. Res. Soc Warrendale, PA, USA, 2003, pages 367-372, XP002341641
	AS		*Hoogeveen R et al: "Texture and Phase Transformation of Sputter-Deposited Metastable Taifilms and Ta/Cu Multilayers" Thin Solid Films, Elsevier-Sequoia S.A. Lausanne, CH, vol. 275, no. ½, 1 April 1996 (1996-04-01), pages 203-206, XP00626342
	AT		*Kim H et al: "The Growth of Tantalum Thin Films by Plasma-Enhanced Atomic Layer Deposition and Diffusion Barrier Properties" Materials Research Society, Pittsburg, PA, US, vol. 716, 2002, pages 407-412, XP008026978

EXAMINER	DATE CONSIDERED
EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.	

* Copies of the documents previously submitted by WIPO.

Form PTO 1449 Rev. 7-80	U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use Several Sheets If Necessary)	Atty. Docket No. CH8498US	Serial No. To Be Assigned
		Applicant Jagdish Narayan et al	
		Filing Date Herewith	Group No.

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							Yes	No
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR	*Pinto R et al: "Getter-Bia Sputtering of High Purity Metal Films in a High Current Vacuum Discharge in the 10-4 Torr Range" Japanese Journal of Applied Physics, Publication Office Japanese Journal of Applied Physics, Tokyo, JP, vol. 9, no. 2, February 1970 (1970-02), pages 174-181, XP000861704
	AS	*Lee S L et al: Texture, structure and phase transformation in sputter beta tantalum coating" Surface and Coatings Technology, Elsevier, [Online] vol. 177-178, 30 January 2004 (2004-01-30), pages 44-51, XP002341669
	AT	**"Method for Controlling the Crystalline Phase of Tantalum" IBM Technical Disclosure Bulletin, IBM Corp. New York, US, vol. 32, no. 5A, 1 October 1989 (1989-10-01), pages 42-43, XP000048830

EXAMINER	DATE CONSIDERED
----------	-----------------

EXAMINER Initial if references considered, whether or not citation is in conformance with MPEP 609: Draw line through if not in conformance and not considered. Include copy of this form with next communication to applicant.

Copies of documents previously submitted by WIPO.